A1 concluded

apparatus for installing conductive spring elements without the need for sockets at opposite ends of the conductive spring element.--

Page 5, delete third and fourth paragraphs and replace with the following:

A2

--Yet another object of the present invention is to provide a compression type electrical connector using conductive spring elements or some other conductive spring configuration.

Still another object of the present invention is to provide a means of protecting conductive spring elements when the electrical connector is not connected.--

Page 5, delete last paragraph continuing on to page 6, lines 1-2, and replace with the following:

A3

--In a first embodiment, the electrical connector according to the present invention utilizes conductive spring elements positioned in a daughtercard interposer and a backpanel interposer electrically to connect the two inner signal carrying conductor wires to conductive pads on a printed circuit board. Shielding members of the conductive spring elements are used to surround stripped (unshielded) sections of twinax cable and to electrically connect the outer jacket to ground planes in the daughtercard and the backpanel and to provide shielding between the closely spaced conductors. Advantageously, the present invention permits the impedance of the connector to be controlled by changing the dielectric thickness and constants.--

Page 6, first full paragraph, delete and replace as follows:

--These and other objects of the present invention are achieved by an interconnect system. including a first interposer housing including a first plurality of shielding members providing shielding for the thickness of the first interposer. A second interposer housing includes a second plurality of shielding members providing shielding for the thickness of the second interposer. At least one cable has a central conductor, a conductive outer jacket, and a dielectric separating the central conductor and the conductive outer jacket. The outer jacket is in electrical contact with at least some of the plurality of shielding members in the first interposer housing and the second interposer housing. A cable housing is connected to the first interposer and to the interposer for retaining the at least one cable. The at least one cable has exposed portions extending beyond the

A5 concluded

cable housing into the first interposer and the second interposer, respectively. At least one conductive spring element is in contact with a central conductor of the at least one cable.--

Page 6, second paragraph, delete and replace as follows:

--The foregoing and other objects of the present invention are achieved by an electrical connector, including a central cable surrounded by a dielectric layer and an electrically conductive jacket. The central cable has exposed opposite ends. A first plurality of shielding members are in electrical contact with one end of the electrically conductive jacket. A second plurality of shielding members are in electrical contact with an opposite end of the electrically conductive jacket. A first conductive spring element is in contact with one of the exposed opposite ends of the central cable. A second conductive spring element is in contact with an opposite exposed end of central cable.--

Page 6, last paragraph continuing on to page 7, lines 1-8, delete and replace as follows:

--The foregoing and other objects of the present invention are achieved by a twinax electrical connector, including a twinax cable having two electrical conductors spaced from each other and having a dielectric surrounding the two electrical conductors and an electrically conductive layer surrounding the dielectric. The two electrical conductors each have exposed opposite ends. A first plurality of shielding members are in electrical contact with one end of the electrically conductive jacket. A second plurality of shielding members are in electrical contact with an opposite end of the electrically conductive jacket. A first set of conductive spring elements are each in contact with a corresponding one exposed end of the two electrical conductors. A second set of conductive spring elements are each in contact with a corresponding second exposed end of the two electrical conductors.--

Page 7, last paragraph and continuing on to page 8, lines 1-24, delete and replace as follows:

A4

The foregoing and other objects of the present invention are achieved by an electrical connector having a plurality of twinax cables arranged in a vertical and horizontal array. A first set of twinax cables are arranged in a vertical array and spaced from each other. Each twinax

cable has a pair of conductors, a dielectric layer and an electrically conductive jacket. A second set of twinax cables are arranged in a vertical array and spaced from each other and horizontally spaced from the first set of twinax cables. A first plurality of conductive spring elements are each positioned against a corresponding conductor. A second plurality of conductive spring elements are each positioned against a corresponding conductor. A cable housing retains the first set and the second set of twinax cables. A first interposer is on one side of the cable housing for receiving one end of the first set and the second set of twinax cables. A second interposer is on another side of the cable housing for receiving an opposite end of the first set and the second set of twinax cables. A first retaining sheet retains signal spring contacts in contact with each pair of conductors on the one end of the first and second set of twinax cables. A second retaining sheet retains signal spring contacts in contact with each pair of conductors on the opposite end of the first and second set of twinax cables. A first interposer slide is biased in a direction away from the first interposer and receives an opposite end of the signal conductors and has a retracted position and a normal extended position. A second interposer slide is biased in a direction away from the second interposer and receives an opposite end of the signal conductors and has a retracted position and an extended position. The conductive spring elements are retained by the first retaining sheet and the second retaining sheet and are protected by the first interposer slide and the second interposer slide, respectively, when each is in the retracted position. The first plurality and the second plurality of conductive spring elements extend beyond the first interposer slide and the second interposer slide, respectively, when each is in the normal extended position.--

Page 8, last paragraph continuing on to page 9, lines 1-24, delete and replace as follows:

--The foregoing and other objects of the present invention are achieved by an electrical interconnect system, including at least one cable having at least one central conductor and a conductive outer jacket with an insulator therebetween. A set of cable housings retains at least one cable. A first interposer cable housing has a first plurality of through holes corresponding to the at least one central conductor and a second plurality of holes partially overlapped in a radial

A8 Concluded

direction with a respective one of the conductive outer jackets. A second interposer cable housing has a third plurality of through holes corresponding to the at least one central conductor and a fourth plurality of holes partially overlapped in a radial direction with a respective one of the conductive outer jackets. A first plurality of electrically conductive spring elements is inserted into the first plurality of through holes in the first interposer. A second plurality of electrically conductive spring elements is inserted into the second plurality of holes in the first interposer. A first interposer slide includes a first interposer cable housing having a first plurality of through holes corresponding to the at least one central conductor. A second plurality of holes is partially overlapped in a radial direction with a respective one of the conductive outer jackets. A first retainer positioned between the first interposer cable housing and the first interposer slide retains the first plurality of electrically conductive spring elements and the second plurality of electrical conductive spring elements. A second interposer cable housing has a third plurality of through holes corresponding to the at least one central conductor. A fourth plurality of holes is partially overlapped in a radial direction with a respective one of the conductive outer jackets. A third plurality of electrically conductive spring elements is inserted into the third plurality of through holes in the second interposer. A fourth plurality of electrically conductive spring elements is inserted into the fourth plurality of holes in the second interposer. A second interposer slide includes a third interposer cable housing having a third plurality of through holes corresponding to the at least one central conductor. A fourth plurality of holes is partially overlapped in a radial direction with a respective one of the conductive outer jackets.--

Page 10, second paragraph, delete and replace as follows:

A9

--The foregoing and other objects of the present invention are achieved by a twinax electrical connector including a latching device. A twinax cable has two electrical conductors spaced from each other and has a dielectric surrounding the two electrical conductors and an electrically conductive layer surrounding the dielectric. The two electrical conductors has exposed opposite ends. A first plurality of shielding members is in electrical contact with one end of the electrically conductive jacket. A second plurality of shielding members is in electrical

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contact with an opposite end of the electrically conductive jacket. A first set of conductive spring elements is in contact with a corresponding one exposed end of the two electrical conductors. A second set of conductive spring elements is in contact with a corresponding one exposed end of the two electrical conductors. A second set of conductive spring elements is in contact with a corresponding second exposed end of the two electrical conductors. A latching mechanism includes a latching device in the housing for latching onto the guide pin.--

Page 10, last paragraph and continuing on to page 11, lines 1-20, delete and replace as follows:

--The foregoing and other objects of the present invention are achieved by an electrical connector having a plurality of twinax cables arranged in a vertical and horizontal array and having a latching mechanism. A first set of twinax cables is arranged in a vertical array and spaced from each other. Each twinax cable has a pair of conductors, a dielectric layer and an electrically conductive jacket. A second set of twinax cables is arranged in a vertical array and spaced from each other and horizontally spaced from the first set of twinax cables. A first plurality of conductive spring elements is each positioned against a corresponding conductor. A second plurality of conductive spring elements is each positioned against a corresponding conductor. A cable housing is retained in the first set and the second set of twinax cables. A first interposer on one side of the cable housing is for receiving one end of the first set and the second set of twinax cables. A second interposer on another side of the cable housing is for receiving an opposite end of the first set and the second set of twinax cables. A first retaining sheet is for retaining signal spring contacts in contact with each pair of conductors on the one end of the first and second set of twinax cables. A second retaining sheet is for retaining signal spring contacts in contact with each pair of conductors on the opposite end of the first and second set of twinax cables. A first interposer slide is biased in a direction away from the first interposer and receives an opposite end of the signal conductors and has a retracted position and a normal extended position. A second interposer slide is biased in a direction away from the second interposer and receives an opposite end of the signal conductors and has a retracted position and an extended

A5 concluded

position. The conductive spring elements are retained by the first retaining sheet and the second retaining sheet and are protected by the first interposer slide and the second interposer slide, respectively, when each is in the retracted position. The first plurality and the second plurality of conductive spring elements extend beyond the first interposer slide and the second interposer slide, respectively, when each is in the normal extended position. A latching mechanism includes a latching device in the housing for latching onto the guide pin.--

Page 11, second and third full paragraphs (lines 24-29) delete and replace as follows:

A6

--The present invention is also directed to a packaging system for retaining conductive spring elements which are used as either ground contacts or signal contacts in the high density electrical connector.

The present invention also is directed to a means of protecting conductive spring elements when not in contact with a conductive trace on a printed circuit board and/or when the electrical connector is not connected to a printed circuit board.--

Page 12, first and second paragraphs, delete and replace as follows:

--The present invention can also be used to protect conductive spring elements. As can be appreciated, the conductive spring elements or the wadded wire cylinders are easily damaged if exposed. To protect the conductive spring elements, sockets have been used at opposite ends of the conductive spring elements and/or precise drilled holes to retain the conductive spring elements.

The sockets protect opposite ends of the conductive spring elements which are installed in through bores. The conductive spring element is placed in the throughbore and the movable sockets or top hats are positioned at opposite ends of the throughbore and are spring loaded by the conductive spring elements to extend beyond the throughbore. Thus, the conductive spring elements are completely surrounded and are protected.--

Page 13, lines 16-21, delete and replace as follows:

A7

--Figure 5 is the same view as Figure 4 with some of the conductive spring elements omitted for clarity;

A7 Concluded

Figure 6 is the same view as Figure 5 with additional conductive spring elements omitted for clarity;

Figure 7 is a bottom perspective view with the conductive spring elements omitted for clarity;--

Page 14, third and fourth paragraphs (lines 7-12) delete and replace as follows:

A8

--Figure 13B is a cross-sectional view of conductive spring elements being retained by the Mylar sheet illustrating one end of the conductive spring elements within the interposer slide when the interposer slide is in an extended position;

Figure 13C is a cross-sectional view similar to Figure 13B illustrating the one end of the conductive spring elements extending beyond the interposer slide when the interposer slide is in a retracted position;--

Page 17, first full paragraph, delete and replace as follows:

A9

--Fuzz buttons and the uses thereof are explained in U.S. Patent No. 4,988,306, issued January 29, 1991, entitled "LOW-LOSS ELECTRICAL INTERCONNECTS", U.S. Patent No. 5,886,590, issued March 23, 1999, entitled "MICROSTRIP TO COAX VERTICAL LAUNCHER USING FUZZ BUTTON AND SOLDERLESS INTERCONNECTS", U.S. Patent No. 6,039,580, issued March 21, 2000, entitled "RF CONNECTOR HAVING A COMPLIANT CONTACT", U.S. Patent No. 4,924,918, issued May 15, 1990, entitled "MACHINE FOR MANUFCTURING BUTTON CONNECTOR AND METHOD THEREFOR", and U.S. Patent No. 5,007,843, issued April 16, 1991, entitled "HIGH-DENSITY CONTACT AREA ELECTRICAL CONNECTORS", all of which are hereby incorporated by reference in their entirety into the present specification. Although the present invention described herein is described with respect to conductive spring elements, it should be understood that fuzz buttons are an illustrative type of conductive spring element or contact and that other types of electrically conductive spring elements or springs can be used with the present invention. The conductive spring element provides high reliability, multiple points of contact and is randomly compressed into a shape that provides multiple electrical contact points to a mating surface.--

A9 Continued

Page 17, last paragraph continuing on to page 18, lines 1-6, delete and replace as follows:

--The conductive spring element may take various suitable forms. As one example, the conductive spring element includes a "watch band" or POGO" pin, comprising at least one spring-loaded pin capable of being compressed. In a further alternative, the conductive spring element includes a bellows device comprising a plurality of deformable folds which are compressible. A further suitable conductive spring element includes a Fuzz Button™ which comprises a conductor formed into a plug-shaped compressible mesh. Alternatively, the conductive spring element may include belleville washers or an element comprised of an elastomer loaded with conductive particles. Preferably, the conductive spring element is plated with gold in order to ensure low, stable RF losses in benign or adverse environments.

The conductive spring element may comprise a single element of one of the above-described, or other types suitable for providing at lest one compliant end or, alternatively, may comprise more than one element, in which case at least one of the elements has at lest one compliant end.--

Page 18, third full paragraph continuing on to entire page 19, delete and replace as follows:

A10

--As illustrated in Figures 1A and 1B, the connector 18 would be assembled by connecting interposer 30 and the backpanel interposer 32. As depicted in Figure 1B, the connector 18 is assembled as follows. First, the twinax cables 40, 42 are formed. All of the conductive spring elements are installed into interposers 30, 32. The twinax cables 40, 42 are then installed into the interposers 30, 32. The assembly is then insert molded to form the over-mold 34 which makes the entire electrical connector 18 rigid. The over-mold 34 is preferably PBT. The electrical connector 18 could then be connected to the daughtercard 20 using fasteners such as screws, rivets, compression posts, and the like.

The conductive spring elements 50, 52, 60, 62 can be made from a single gold plated fine wire that is compressed into a very small shape. The resulting object is a wire mass having spring performance and demonstrates superior electrical signal conduction from high current DC

to microwave frequencies. The typical size of a conductive spring element is 0.01 inch in diameter by 0.060 in length. The signal carrying conductive spring elements preferably have the same outer diameter as the signal carrying center cable. The ground contact conductive spring elements do not have to be the same diameter or length as the signal carrying conductive spring elements. The conductive spring elements 50, 52, 60, 62 are employed in the illustrative embodiments, preferably each formed from a strand of metal wire, each strand being wadded together to form a desired cylindrically shaped "button" of material having a density of between 20% and 30%. As depicted in Figures 1A and 1B, each wadded-wire connected conductive spring element fits snuggly in openings of the daughtercard interposer 30 and the backpanel interposer 32. The wadded-wire conductive spring elements 50, 52, 60, 62 make electrical contact at multiple points when compressed against the contact area. Connectors of this type have significant advantages over other types of connectors and provide connections of high integrity and reliability. In contrast to other types of connections, this mechanical connector element has very few associated variables that can affect the quality of the connection. The only significant variables are the size of the connector element and the compressive force used to make the connection, both of which can be accurately controlled by controlling the volume into which the conductive spring element is placed. Alternatively, in high vibration environments, the conductive spring elements can be epoxied in place using a conductive epoxy.

The conductive spring elements employed in the illustrative embodiments can be fabricated using nickel wire, or wire made from alloys such as beryllium and copper, silver and copper, or phosphorous and bronze. The compression of the wadded wire of conductive spring elements is substantially elastic so that, when the compressive force of the twinax cables is removed, the conductive spring elements return to their original shape. The wire is randomly compressed into a cylindrical shape and the wire has some spring constant associated with it to provide resiliency when pressure is applied. Advantageously, this allows the electrical connector 18 according to the present invention to be connected and disconnected as many times as is needed. In the embodiments described the wadded-wire conductive spring elements 50, 52, 60,

A10 concld

62 can be manufactured by Technical Wire Products, Inc. of Piscataway, New Jersey, under the trademark Fuzz Button™.--

Page 20, beginning with second paragraph, delete through to page 23 (lines 1-13) and replace as follows:

A11

--As depicted in Figure 2, the backpanel interposer 32 has two opposed U-shaped openings 100, 102 each having an outer U-shaped peripheral wall 110, 112, respectively, an inner U-shaped peripheral wall 117, 118 and a straight wall 114, 116, respectively. Walls 114 and 116 face each other as depicted in Figure 2. Inserted into the U-shaped openings are a plurality of conductive spring elements 200, 202, 204, 206, respectively, each being in a half U-shape as depicted in Figure 2. For example, conductive spring elements 200, 202 each have a half U-shape and when placed together form a U partially surrounding the twinax cable 40. It should be understood that other shielding methods could be used to replace the conductive spring elements.

The twinax cable 40 has two central conductors 120, 122 surrounded by a Teflon™ sheathing 124. Preferably, signal carrying conductive spring elements 300-306 (see Figure 3) have the same outer diameters as the two central conductors 120, 122. The Teflon™ sheathing 124 in turn is surrounded by an electrically conductive copper layer which forms a rigid or semi-rigid outer case 128 made of copper and aluminum or a tin filled braiding. Case 128 may be applied using a plating process. As depicted in Figure 2, the rigid outer case 128 is stripped away to a length E, thereby exposing the Teflon™ sheathing 124. The Teflon™ sheathing 124 is stripped away from the central conductor to a length F. This stripping is done symmetrically on both ends of twinax cables 40, 42. The conductive spring elements 200, 202, 204, 206 are in electrical contact with the layer 128 so as to form a shield.

Refer now to Figure 3 which depicts a bottom view of Figure 2. Mounted within the interposer 32 are conductive spring elements stacked one upon another in a half U-configuration through the thickness of interposer 32 for surrounding and shielding the central twinax leads 120, 122, respectively, of twinax cables 40, 42. Also depicted are a plurality of vertically extending

A 11 Cont

cylindrical conductive spring elements 210, 212, 214 which are positioned between walls 114, 116. The conductive spring elements 210, 214 extend through the thickness of interposer 32 and are used to shield twinax cables 40, 42 from each other. As depicted in Figure 3, it should be understood that there is a full 360° shielding for twinax cables 40, 42 for the stripped away portions of coax cables 40, 42 which extend through the interposer 32. As depicted in Figure 3, there are four conductive spring elements 300, 302, 304, 306 are in contact with the exposed portions of central conductors 120, 122 of twinax cables 40, 42.

Figure 4 is an illustration similar to Figures 2 and 3 in which the daughtercard interposer 32 has been omitted for clarity. As is evident in Figure 4, there are four stacks of half U-shaped conductive spring elements 200, 222, 224, 226, 228; 202, 232, 234, 236, 238; and 204, 242, 244, 246, 248, 206, 252, 254, 256, 258 (not shown). These four stacks together with the vertically extending conductive spring elements form a full 360° shield around twinax cables 40, 42. It is envisioned that the uppermost and lowermost conductive spring elements will be used in the present invention. However, it is possible to use structures other than conductive spring elements to electrically connect the uppermost and the lowermost conductive spring elements. For example, a stamped and formed metal component (not shown) can be used to electrically connect the uppermost and the lowermost conductive spring elements.

Refer now to Figure 5 which is similar to Figure 4 except that conductive spring elements 200, 222, 224, 226 and 228 have been omitted to show conductive spring elements 306, 304 in contact with central conductors 122, 120, respectively.

As depicted in Figure 6, it can be seen that conductive spring elements 300, 302 and also 304, 306 (not shown) contact the exposed portions of the central signal carriers 120, 122. These conductive spring elements 300-306 are the signal carrying conductive spring elements. It is important that the signal carrying conductive spring elements are substantially the same diameter as the twinax central conductors 120, 122 to maintain constant impedance. It is also envisioned that other types of spring contacts could be used in the present invention. For example,

A11 Cont.

conductive textiles may be used. Compression springs could also be used. The conductive textile may be injected into the connector replacing the conductive spring elements.

Refer now to Figure 7 where a bottom perspective view of the electrical connector 18 is depicted. As depicted in Figure 7, a central portion 701 is formed between the straight wall 114 and the bottom of the outer U-shaped wall 110. The central portion 701 includes through holes 700 and 702 which receive vertically extending conductive spring elements 300, 302. A wall 704 is formed centrally in the U-shaped area to form a first half U-shaped opening 710 and a second U-shaped opening 712 which receive conductive spring elements 206, 252, 254, 256, 258 and 204, 242, 244, 246, 248, respectively. It is envisioned that there could be a two piece construction and the center support structure could be a separate member constructed of a Teflon™ dielectric. Also, metal plated plastic components could be used.

As depicted in Figure 8, a plurality of electrically non-conductive patterns 402, 404 are on the daughtercard 20 and the backpanel 22, respectively. The pattern 402 has an electrically conductive area 410 having roughly a figure eight configuration. The patterns can be formed using known photolithographic techniques. A first non-conductive area 412 and a second non-conductive area 414 are spaced apart from each and within an outer periphery 420 of the pattern 402. The first non-conductive area 412 has two areas 430, 432 which include conductive pads 440, 442. The second non-conductive area 414 has two areas 434, 436 which include conductive pads 444, 446. Openings 430, 432, 434, 436 receive the center conductors 120, 122 of twinax cables 40, 42 that extend from the interposer 30 such that conductive spring elements 300, 302, 304, 306 are brought into contact with the conductive pads 440, 442, 444, 446, respectively. Referring back to Figure 4, conductive spring elements 228, 238, 248 and 258 will be in electrical contact with the electrically conductive area 410. In this manner, the conductive spring elements provide a shielding path to ground. The electrically conductive area 410 is connected to ground plane on the daughtercard and on the backplane. The inner surfaces of openings 430, 432, 434, 436 are electrically conductive and are connected to signal paths so that conductive spring elements 306, 304, 302, 300 are in electrical contact therewith when the interposer 30 is

A11 concluded

used to connect the daughtercard 20 and the backpanel 22. Conductive spring elements are mounted in the interposer 32. Advantageously, the conductive spring elements 300, 302, 304, 306 will be compressed when the daughtercard and backpanel are mated which provides a normal force on the signal line and on the cable. The conductive spring elements 300, 302, 304, 306 and 228, 238, 248, 258 will be compressed to the board 20 maintaining normal forces with respect to the daughtercard pattern 402. The pattern 404 on the backpanel 22 is the same as the pattern 402 and need not be described in detail herein. The pattern 404 includes an electrically conductive portion 458 and a first non-conductive area 460 and a second non-conductive area 462. Advantageously, the electrical connector 18 of the present invention can be connected and reconnected multiple times without degrading the signal contacts 300, 302.--

Page 25, beginning with last paragraph, delete through to page 31, line 4, and replace as follows:

A12

--A plurality of conductive spring elements 1034, 1036 are retained by Mylar retainers 1038, 1040, respectively. The Mylar retainers 1038, 1040 could be made from any suitable material including heat shrinkable plastic. The conductive spring elements 1034, 1036 are strategically placed and extend within interposer cable housing 1030, 1032 and interposer slides 1042, 1044, respectively. The front surface 1030' of the interposer 1030 is rigidly mounted to the front surface 1026 by either press fit studs, ultrasonic welding or epoxy. A pair of opposed pins 1009, 1009' extend from the surface 1026 and the guide blocks 1002, 1004, respectively, into recessed holes which (not shown) extend inwardly from the surface 1030'. The pins 1009, 1009' keep the interposer 1030 aligned with the cable housings 1006-1014. Pins (not shown) extend from the surface 1026 of the guide blocks 1002, 1004 to keep the interposer 1032 aligned with the cable housings 1006-1014. The conductive spring elements 1034, 1036 include ground contact conductive spring elements and signal carrying conductive spring elements as explained below. A pair of guide pins 1046, 1048 are provided on the backpanel for mounting the electrical connector 1000 thereto. Guide pins 1046, 1048 extend through holes 1050, 1035 and 1048, 1033, respectively, and mate with the latching mechanisms described below. As depicted

A12
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in Figure 10, a cylindrical guide socket body 1003 extends from the guide block 1002 for receiving the guide pin 1048. Guide block 1004 has a similar guide socket body (not shown) for receiving guide pin 1046. The guide blocks 1002, 1004 each have a threaded insert 1027, 1029, respectively, positioned at right angles from the guide socket body 1003 and aligned with corresponding holes 1061, 1063 in interposer 1030 and holes 1080, 1082 in the interposer slide 1042. Threaded fasteners extend from the daughtercard to fasten the electrical connector 1000 to be threaded into the threaded inserts 1027, 1029.

Turning now to Figure 11, it can be more clearly seen that the Mylar sheet 1038 includes a plurality of stamped holes. The stamped holes are in a specific pattern for retaining and placing the conductive spring elements in holes in the interposers 1030, 1032 and the interposer slides 1042, 1044. The holes used to retain the signal carrying conductive spring elements must be held to tight tolerances to hold the conductive spring elements securely yet not so tight to overly compress the conductive spring elements and significantly change the outer diameter thereof.

Stamped holes 1070, 1072, 1074 and 1076 are in vertical alignment for receiving retaining tines 1090, 1092, 1094, 1096 in the interposer 1030. The holes 1404, 1406 and the retaining tines 1090-1096 maintain the interposer slide 1042 in alignment with the interposer 1030. The retaining tines 1090-1096 are of sufficient length to permit the interposer slide 1042 to be biased into the extended position by springs 1091, 1093 mounted in holes 1095, 1097 in the surface 1030" of the interposer 1030. The retaining tines 1090-1096 will be flush or below surface 1092 in the retracted position. The conductive spring elements 1034 maintain the alignment of the Mylar sheet 1038 relative to the interposer 1030 and the interposer slide 1042. The interposer 1030 includes a top set of holes 1110 for receiving the leads of conductor 1020, middle holes 1112 for receiving the center leads of conductor 1022 and a bottom set of holes 1114 for receiving the leads of the conductor 1024. Each interposer has multiple ground holes, for example, four ground holes, into which conductive spring elements are placed to make contact with the outer conductive layer 128 of each of the conductors 1020, 1022, 1024. For example, as depicted in Figure 11 with respect to conductor 1020, the interposer 1030 has holes

A18 Cont.

1120, 1122, 1124, 1126. The Mylar sheet has corresponding holes 1130, 1132, 1134, 1136. Each interposer 1030, 1032 includes a plurality of recesses shaped to match the exterior of each of the conductors 1020, 1022, 1024. As depicted in Figures 11 and 12, the electrical conductors have a straight center section and rounded outer sections. The conductive spring elements placed in holes 1130, 1132, 1134, 1136 will be in contact with the outer jacket 128 of the conductor and will provide a ground path and electrical shield between adjacent twinax cables. The recess 1150 extends inwardly from front surface 1032' of the interposer 1032. For example, the recess 1150 is formed by opposed curved walls 1160, 1162 connected by straight sections 1170, 1172. The straight sections 1170, 1172, as depicted extend horizontally. The recess 1150 is shaped to receive the outer jacket 128 of the twinax cable.

Turning now to Figure 12, the interposer 1032 is depicted in large scale. It should be understood that interposers 1030, 1032 are identical except for the opposed holes used for the guide pins 1046, 1048 which extend through interposer 1032 into guide blocks 1002, 1004, respectively. The holes 1048, 1050 are offset relative to a longitudinal centerline of the interposer slide 1044 as are holes 1033, 1035 which are aligned therewith. By contrast, the holes 1066, 1068 in the interposer 1030 are on the centerline as are the holes in the interposer slide 1048.

Each central conductor 120, 122 have multiple conductive spring elements associated with it. For example, as depicted in Figure 12, there are two holes 1260, 1262 aligned with the central conductors 120, 122. There are also two central conductive spring elements (not shown) which make contact with the central leads of the conductors 120, 122 and which have one end in the holes 1260, 1262. A front surface of the insulator 124 can bottom out in the recess 1150. With respect to the recess 1150, there are four conductive spring elements 1250, 1252, 1254, 1256 installed in holes 1280-1284. Holes 1280-1284 are blind holes and intersect with the periphery of the recess 1150. One ground contact, preferably a conductive spring element (not shown) is installed in the holes 1250-1256 and are used as ground contacts with the electrically conductive outer jacket 128 of the central conductor. Four ground contacts provide excellent

B13 Cont.

shielding. Additional holes and conductive spring elements can be added to enhance cross-talk reduction.

It should be noted that hole 1250 is centrally located between signal carrying conductive spring elements 1260, 1262. Hole 1254 is offset relative to the center of recess 1150 closer to hole 1260, whereas in the adjoining recess 1152, hole 1270 is offset in the opposite direction. It should be noted that excellent electrical shielding is achieved without having to provide 360 degree coverage of each of the twinax cables. Thus, adjacent vertically aligned recesses have offset holes for conductive spring elements. By offsetting the holes, a greater percentage of the circumference is shielded.

Referring now to Figures 13A, B and C and referring to the interposer slide 1042, it should be seen that there are four vertically aligned holes 1370, 1372, 1374, 1376 for receiving tines 1090, 1092, 1094, 1096, respectively. Preferably, the interposer 130 will be spring loaded in a direction away from interposer 1030. This protects the conductive spring elements from becoming damaged or dislodged during shipping and assembly. It should be understood that the explanation is provided only for the left most set of holes and that the hole pattern repeats. The upper most conductor 1020 has a set of corresponding holes in the interposer 1042. Hole 1330 for receiving a ground conductive spring element aligns with hole 1130 in the Mylar sheet and hole 1120 in interposer 1030. Hole 1332 aligns with hole 1132 in the Mylar sheet and hole 1122 in the interposer. Hole 1334 aligns with hole 1134 in the Mylar sheet and hole 1124 in the interposer 1030. Hole 1336 aligns with hole 1136 in the Mylar sheet and hole 1126 in interposer 1030. Similarly, holes 1380 align with holes 1080 in the Mylar sheet 1038 and holes 1110 in the interposer 1030. As depicted in Figure 13A, the interposer 1032 is illustrated in an extended position in which the conductive spring elements are below the surface 1042" or at maximum 0.020 above the surface 1042" and are thereby protected during shipment of the electrical conductor 1000. As depicted in Figure 13A, there is a gap between the surface 1032" of the interposer 1032 and the surface 1042 of the interposer slide. The conductive spring elements are held between the interposer 1030 and the interposer slide 1048 are in contact with the

daughtercard 20. By contrast, the interposer 1032 and the interposer slide 1044 are in contact with the backpanel 22.

The backpanel printed circuit board with guide has a plurality of conductive pads 1390. The pads have two signal carrying conductors 1392, 1394 to be brought into contact with the signal carrying conductive spring elements and an outer ground section 1396 (see Figure 14). The pads 1390 advantageously do not have to be through plated holes. The pads 1390 can be surface mount or can have blind vias. By avoiding through plated holes, capacitive effects associated with the holes are reduced and speed can be increased.

It is important to provide shielding for the length of the exposed central conductor and for the length of the signal carrying conductive spring elements to prevent cross-talk between adjacent twinax cables. The present invention advantageously achieves this shielding using four conductive spring elements connected to ground. These conductive spring elements provide less than 360° shielding but testing has revealed that the level of shielding achieved is sufficient to provide data rates up to 10 Gb/sec and greater.

Further, the Mylar sheet 1038 retains the signal carrying conductive spring elements by compressing the conductive spring elements around the circumference without reducing the outer diameter significantly. Thus, the diameter of the conductive spring elements is not changed significantly when compressed into the PC board. Also advantageously, the force exerted by the conductive spring element in a direction away from the PC board is relatively small thus allowing the use of the latching mechanism according to the present invention. By changing the shape, number and rigidity of the conducting elements, the contact resistance, contact force and compressibility can be selected within a wide range to meet the needs of the particular application. The overall cumulative contact force of conductive spring elements 1039, 1036 against contact surfaces 1390 is low due to the resilient construction and compressibility of the conductive spring elements.

Because the electrical connector according to the present invention is a compression mount-type, a unique latching device is preferably used with the electrical connector depicted in

A12 concluded

Figures 10-14. To ensure a good electrical connection, between the conductive spring elements and the PC board pads, the daughtercards must not be able to back out of its position in the slot beyond a predetermined distance. This predetermined distance is calculated to ensure the minimum amount of normal force required for an acceptable electrical connection. The latching device can advantageously be used with all compression mount type connectors and is not limited to the compression type connector described herein. A connector guidance module is used as device for maintaining a latched position for an interconnect system. The latching device maintains intimate contact between compression mount contacts (conductive spring elements) and the PC board surface without using additional fasteners. The latching device will operate very similarly to a quick disconnect hose fitting, but will not necessarily have a positive lock requiring more than just enough force to disengage the latch device. The spring members and guide pin shape are designed for mating of the latching device with a minimum of force into a latched position. A groove in the guide pin and the latching device are designed to require more force to separate than the force generated by he compression contacts against the PC board in a direction to force the latching into an unlatched position.--

Page 32, delete first full paragraph (lines 7-27) and replace as follows:

A13

-- Each of the twinax cable embodiments is particularly suitable for differential signaling. A driver on one board sends out two signals and at the receiving board, the difference between the two signals is measured and the actual signal pulse is determined. Because the two conductors are shielded from adjacent twinax cables by the conductive jacket, the twinax cable is especially useful for differential signaling. With a differential pair each signal is transmitted on two lines 140, 142 at the same time. On one, the signal is transmitted as a positive (+) signal, on the other as a negative (-) signal. At the receiving end of the signal path the receiver device gets two signals. Both signals, however, have been changed by the noise that penetrated through the outer jacket 128 and through the conductive spring element shielding over the signal path. The changes came in the form of unwanted voltage added to the wanted signal. At this point it is important to note that the unwanted voltage is added to both lines at the same time and by the

A13 Concluded

same amount. The essence of the differential system is that the receiver is designed to subtract the difference between the two signals on the two lines. In doing that, because the noise part of the signal is equal on both lines, the noise cancels out and effectively is eliminated. As indicated above, the differential system works well if the noise added is equal on the two lines, i.e., the positive (+) and the negative (-). To ensure that the noise affects both of these lines identically, both of them need to occupy theoretically the same physical space. This is true in the present invention in which the two physical lines are within the twinax cable structure.--

Page 32, last paragraph (lines 28-29) continuing on to page 33, lines 1-8, delete and replace as follows:

-- Referring now to Figure 16, the electrical connector 1000 is shown engaged with the daughtercard 20. The interposer slide 1042 is depicted in a retracted engaged position. The interposer slide 1044 is shown in an extended non-engaged position. The Mylar sheet 1038 is in contact with the surface 1030". When interposer slide 1044 engages with the top surface of the backpanel 22, the interposer slide 1044 will slide inwardly to a retracted engaged position. The latching mechanism will engage with the grooves 1552 of pins 1501, 1503 such that all of the conductive spring elements will be in proper contact with the daughtercard and backpanel pads. This is depicted in Figure 17 where the electrical connector 1000 is connected to the daughtercard 20 and the backpanel 22.--

Page 33, last paragraph, continuing on to page 34 (lines 1-4), delete and replace as follows:

A14

--Figure 20 depicts the guide module, in a partially mated condition, with one half of the housing removed and the guide socket 1510 omitted to expose the latching mechanism. This illustrates how the springs and latching devices operate during the mating process. In Figure 20, the spring members 1562-1566 bias the latching devices 1522-1526 inwardly. In the partially mated condition the inner surfaces 1522'-1526' are in contact with cylindrical surface 1558 of the guide pin 1550. When the guide pin 1510 engages the latching devices 1522-1526, the latching devices 1522-1526 are biased radially inwardly as depicted in Figure 23 and the latching